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How Does A Microwave Oven Work?

Basic Theory of Operation

Excerpts from the book *The Complete Microwave Oven Service Handbook*
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EXHIBIT

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How A Microwave Oven Works

Microwave ovens use various combinations of electrical circuits and mechanical devices to produce and control an output of microwave energy for heating and cooking. Generally speaking the systems of a microwave oven can be divided into two fundamental sections, the **control section** and the **high-voltage section**.

The **control section** consists of a timer (electronic or electromechanical), a system to control or govern the power output, and various interlock and protection devices. The components in the high-voltage section serve to step up the house voltage to high voltage. The high voltage is then converted microwave energy.

Basically, here is how it works: As shown in **Figure 1**, electricity from the wall outlet travels through the power cord and enters the microwave oven through a series of fuse and safety protection circuits. These circuits include various fuses and thermal protectors that are designed to deactivate the oven in the event of an electrical short or if an overheating condition occurs.

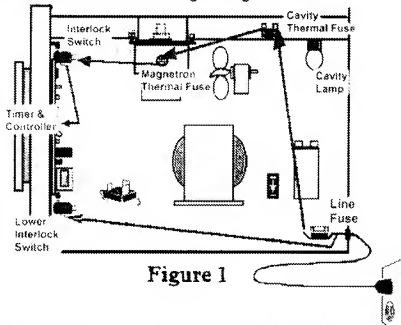
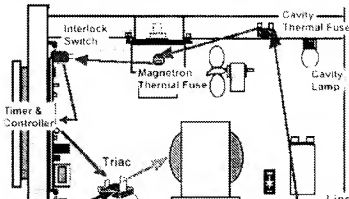


Figure 1

If all systems are normal, the electricity passes through to the interlock and timer circuits. When the oven door is closed, an electrical path is also established through a series of safety interlock switches. Setting the oven timer and starting a cook operation extends this voltage path to the **control circuits**.



Generally, the control system includes either an electromechanical relay or an electronic switch called a triac as shown in **Figure 2**. Sensing that all systems are "go," the control circuit generates a signal that causes the relay or triac to activate, thereby producing a voltage path to the high-voltage transformer. By adjusting the on-off ratio of this activation signal, the control system can govern the application of voltage to the high-voltage transformer, thereby controlling the on-off ratio of the magnetron tube and therefore the

output power of the microwave oven. Some models use a fast-acting power-control relay in the high-voltage circuit to control the output power.

in the **high-voltage section** (**Figure 3**), the high-voltage transformer along with a special diode and capacitor arrangement serve to increase the typical household voltage, of about 115 volts, to the shockingly high amount of approximately 3000 volts! While this powerful voltage would be quite unhealthy -- even deadly -- for humans, it is just what the magnetron tube needs to do its job -- that is, to dynamically convert the high voltage in to undulating waves of electromagnetic cooking energy.

The microwave energy is transmitted into a metal channel called a **waveguide**, which feeds the energy into the cooking area where it encounters the slowly revolving metal blades of the **stirrer blade**. Some models use a type of **rotating antenna** while others rotate the food through the waves of energy on a revolving carousel. In any case, the effect is to evenly disperse the microwave energy throughout all areas of the cooking compartment. Some waves go directly toward the food, others bounce off the metal walls and flooring, and, thanks to special metal screen, microwaves also reflect off the door. So, the microwave energy reaches all surfaces of the food from every direction.

All microwave energy remains inside the cooking cavity. When the door is opened, or the timer reaches zero, the microwave energy stops--just as turning off a light switch stops the glow of the lamp.

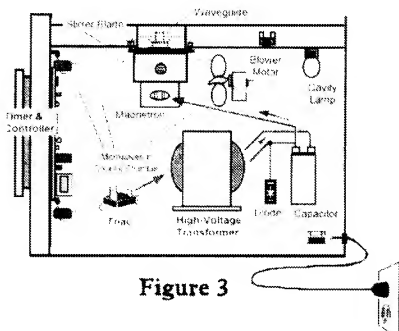



Figure 3

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